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Online:WPI,EPODOC,JAPIO

(54) Abstract Title
A forklift

(57) A forklift (1, Fig.1) comprises a tiltable operating lever 3, a tiltable mast (4), and a liftable fork (5) disposed on the mast. The lifting/lowering speed of the fork is controlled by a solenoid valve 61 and the tilting speed of the mast is controlled by a solenoid control valve 62, the valves being opened to a degree proportional to the tilting angle of the operating lever sensed by a detector 10. When the operating lever is tilted with switch 9 operated, valve 62 is operated to tilt the mast and when the operating lever is operated without operation of the switch, valve 61 is operated to lift/lower the fork. Release of the switch during tilting of the mast will cause the actions of lifting and lowering the fork and tilting the mast to be disabled by an inhibiting circuit 72 until the operating lever is returned to a neutral condition.

FIG.2

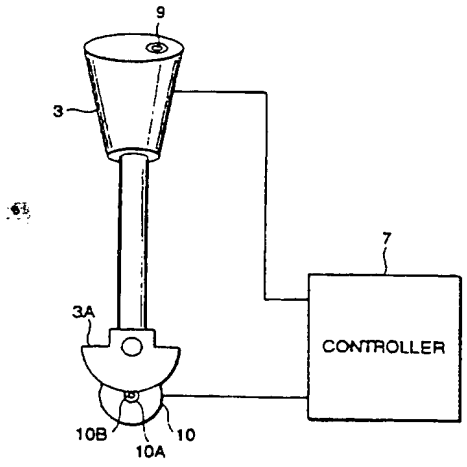
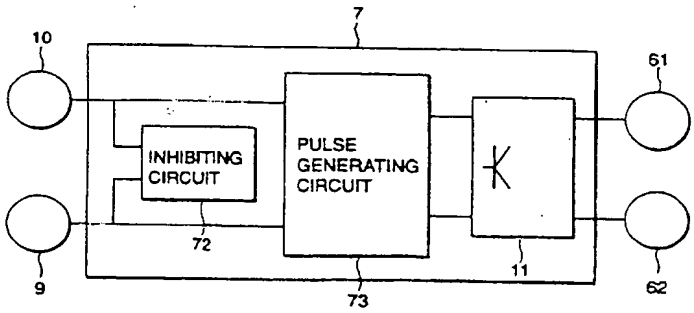


FIG.3



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG.1

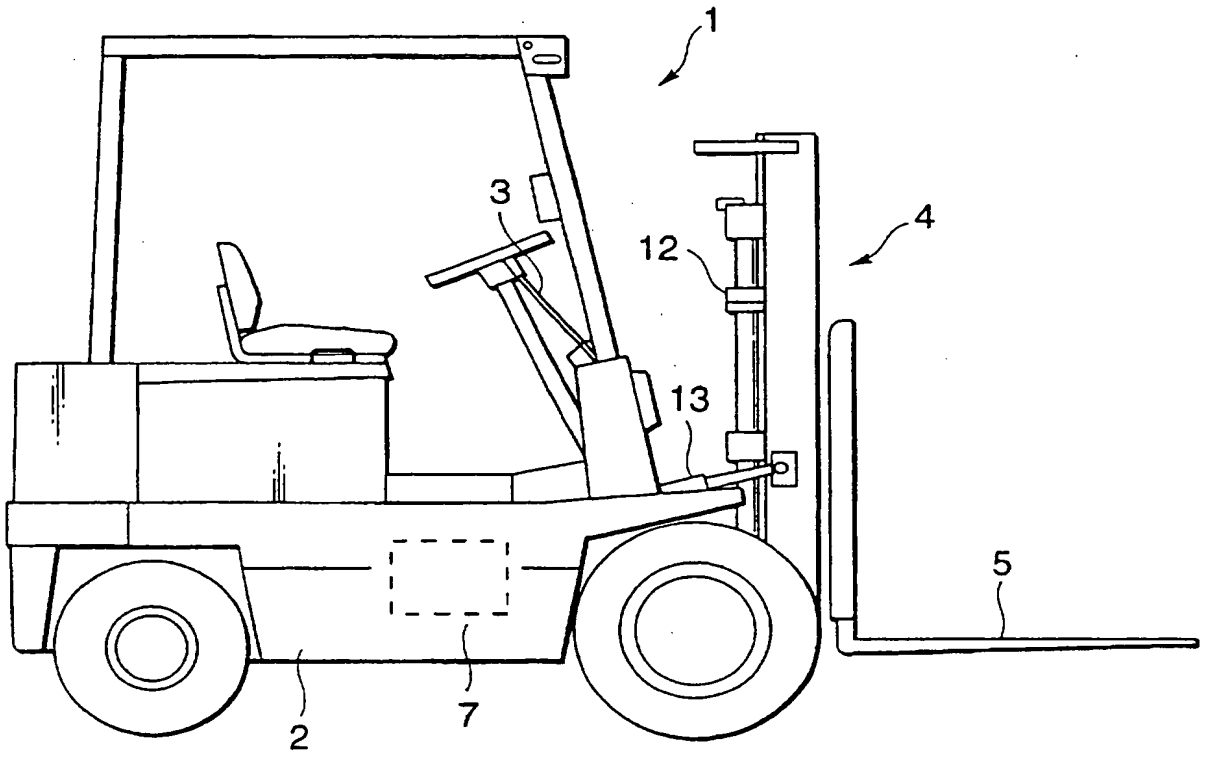


FIG.2

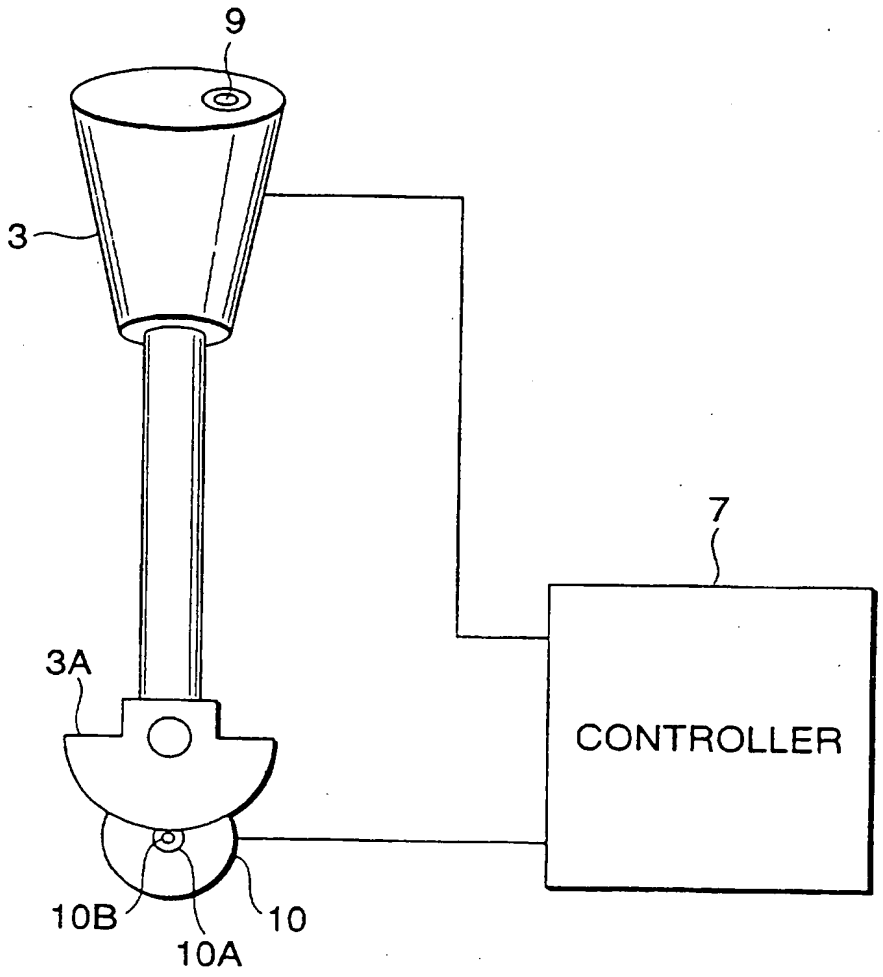


FIG.3

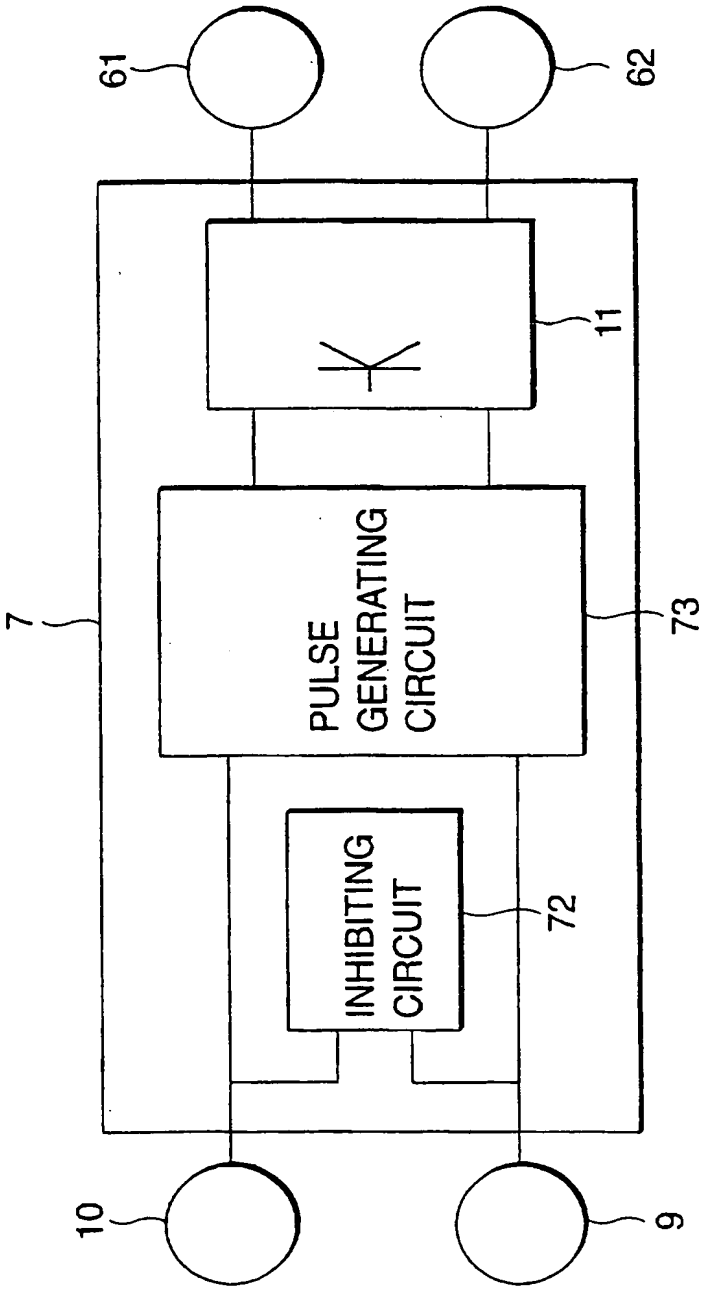
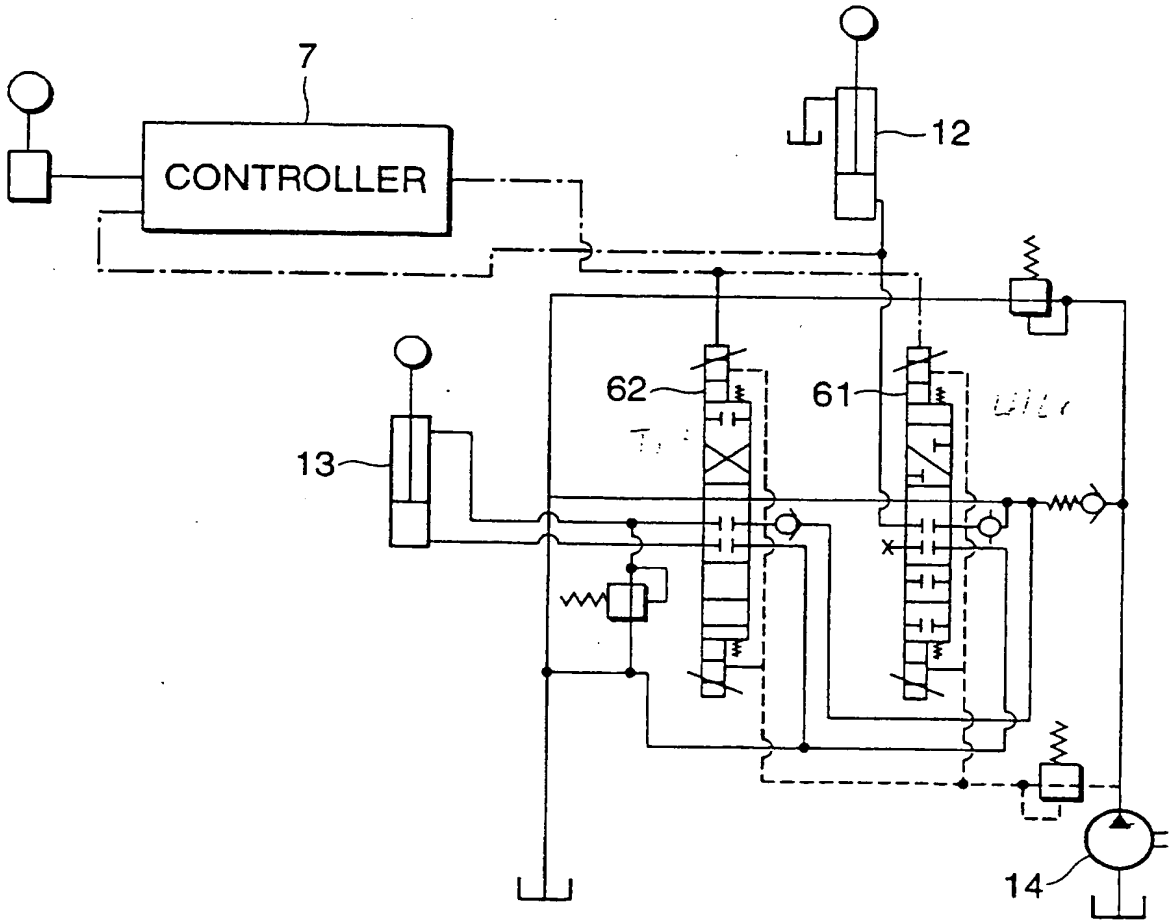

61
62
11
7
PULSE GENERATING CIRCUIT
73
INHIBITING CIRCUIT
72
10
9

FIG.4



LOAD HANDLING APPARATUS FOR A COUNTERBALANCE TYPE FORKLIFT

The present invention relates to a load handling apparatus for a counterbalance type forklift in which actions of lifting and lowering a fork, and tilting a mast are conducted by means of a single operating lever for handling a load. The load handling apparatus is configured so as to prevent the action condition from being suddenly changed by an erroneous operation, thereby improving safety.

In a conventional counterbalance type forklift actions of lifting and lowering a fork, and tilting a mast are conducted by means of a single operating lever for handling a load. In such a counterbalance type forklift, a push button switch is disposed on the load operating lever, and an operation of only the load operating lever and that of both the load operating lever and the push button switch are selectively employed. When, during a period when both the load operating lever and the push button switch are operated, the push button switch is released by any reason, therefore, the action condition intended by the driver is suddenly changed to that not intended by the driver, thereby producing a problem in that the driver may receive an injury.

An object of the present invention is to provide a load handling apparatus for a counterbalance type forklift which prevents the above defects with the conventional apparatus.

To achieve the above object, according to the present invention, there is provided a load handling apparatus for a counterbalance type forklift in which a tiltable operating lever is disposed on a body of the forklift, a mast which is tiltable in an anteroposterior direction is disposed on the forklift, a liftable fork is disposed on the mast, and a tilting speed of the mast and lifting and lowering speeds of the fork are controlled by a degree of opening of a solenoid proportional control valve, the degree of opening being proportional to a tilting angle of the operating lever, wherein a switch is attached to the operating lever, and the apparatus comprises a controller which performs controls in the following manner: when the operating lever is tilted under a state where the switch is operated, a signal for tilting the mast is output; when only the operating lever is operated, a signal for lifting or lowering the fork is output; and, when the switch is changed to an inactive condition under a state where the operating lever is in an tilting operation condition, actions of lifting and lowering the fork are disabled unless the operating lever is returned to a neutral condition.

An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a side view of a counterbalance type forklift comprising load handling apparatus of the invention;

Fig. 2 is a side view of an operating lever of the load handling apparatus;

Fig. 3 is a block diagram of a controller of the load handling apparatus; and

Fig. 4 is a diagram of a hydraulic circuit of the load handling apparatus.

Fig. 1 is a side view of a counterbalance type forklift (hereinafter, referred to as merely "forklift"). The forklift 1 includes a body 2, a mast 4 which is tiltably disposed in front of the body 2, and a fork 5 which is liftably disposed on the mast 4. A single operating lever 3 is tiltably disposed on the body 2. A switch 9 is disposed on a tip end of a gripping portion of the operating lever 3. As shown in Fig. 2, a first sector

gear 3A is fixed to an end of the operating lever 3. A second gear 10A which is fixed to a rotation shaft 10B of a rotational amount detector 10 (such as a potentiometer or an encoder) meshes with the first gear 3A. The lifting and lowering speeds of the fork 5, and the tilting speed of the mast 4 are controlled by the degree of opening of a solenoid proportional control valve which is proportional to the tilting angle of the operating lever 3.

When the operating lever 3 is singly operated, an output of the potentiometer 10 which is proportional to the tilting angle of the operating lever 3 is supplied to a controller 7. The degree of opening of a first solenoid proportional control valve 61 is controlled by an output control signal supplied from the controller 7, thereby controlling the lifting and lowering speeds of the fork 5. In contrast, when the operating lever 3 is operated while the switch 9 is kept to be operated, the output of the potentiometer 10 which is proportional to the tilting angle of the operating lever 3 is supplied to the controller 7. The degree of opening of a second solenoid proportional control valve 62 is controlled by an output control signal supplied from the controller 7, thereby controlling the tilting speed of the mast 4.

The controller 7 receives an output of the rotational amount detector 10, and an electric signal of the push

button switch 9, and converts them into electric signals of a desired frequency. The converted electric signals are supplied to a solenoid proportional control valve driving circuit 11 connected to the first and second solenoid proportional control valves 61 and 62, to obtain degrees of opening which are proportional to the tilting angle of the operating lever 3. As a result, actions of lifting or lowering the fork 5, and tilting the mast 4 are conducted at respective predetermined speeds.

The controller 7 is configured in the following manner. When the operating lever 3 is operated while the switch 9 is kept to be operated, the action of tilting the mast 4 is obtained. When the switch 9 is released during this operation, an inhibiting circuit 72 shown in Fig. 3 is activated so as to block the pulse generation in a pulse generating circuit 73, thereby stopping the tilting action of the mast 4 and the lifting or lowering action. When the operating lever 3 is once returned to a neutral position, the inhibiting condition of the inhibiting circuit 72 which has been activated is cancelled, so as to attain a state where pulses generated by the pulse generating circuit 73 are enabled to be applied to the solenoid proportional control valve driving circuit 11.

In a hydraulic circuit shown in Fig. 4, used are two solenoid proportional control valves, i.e., the first

solenoid proportional control valve 61 which is used for lifting or lowering the fork 5, and the second solenoid proportional control valve 62 for tilting the mast in an anteroposterior direction. The first solenoid proportional control valve 61 is connected to a pipe between a fork action cylinder 12 and a hydraulic pump 14. The second solenoid proportional control valve 62 is connected between a mast tilting cylinder 13 and the hydraulic pump 14. Pressure oil from the hydraulic pump 14 is supplied to the fork action cylinder 12 or the mast tilting cylinder 13, via one of the first and second solenoid proportional control valves 61 and 62 which one is selected by the above-mentioned switching function. Therefore, the fork is lifted or lowered by the fork action cylinder 12 so that the lifting and lowering actions are conducted at a speed which is proportional to the tilting angle of the operating lever 3, or the mast 4 is tilted forward or rearward by the mast tilting cylinder 13. Also the tilting action in an anteroposterior direction is conducted at a speed which is proportional to the tilting angle of the operating lever 3.

As described above, according to the invention, because of the above-described configuration, the action of lifting or lowering the fork, and that of tilting the mast can be conducted by the single operating lever without paying attention to the operation direction, and hence the

operability is improved. In the case of an erroneous operation of the switch, the tilting action of the mast and the lifting and lowering actions of the fork are disabled. Furthermore, the operation for the lifting action and that for the tilting action cannot be simultaneously conducted. Therefore, the safety can be further improved.

WHAT IS CLAIMED IS:

1. A load handling apparatus for a counterbalance type forklift, comprising:

a tiltable operating lever disposed on a body of the forklift;

a mast tiltable in an anteroposterior direction and disposed on said forklift;

a liftable fork disposed on said mast;

a solenoid proportional control valve, in which a tilting speed of said mast and lifting and lowering speeds of said fork are controlled by a degree of opening of said solenoid proportional control valve, said degree of opening being proportional to a tilting angle of said operating lever;

a switch attached to said operating lever; and

a controller for controlling so as to output a signal for tilting said mast when said operating lever is tilted under a state where said switch is operated, output a signal for lifting or lowering said fork when only said operating lever is operated; and disable actions of lifting and lowering said fork when said switch is changed to an inactive condition under a state where said operating lever is in an tilting operating condition, unless said operating lever is returned to a neutral condition.

2. A load handling apparatus as claimed in claim 1, wherein said controller includes an inhibiting circuit for stopping the tilting action of the mast and the lifting or lowering action of the fork when said switch is released while said operating lever is being operated.

3. A load handling apparatus substantially as hereinbefore described, with reference to, and as shown is, the accompanying drawings.

The Patent Office

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Application No:	GB 9922804.1	**Examiner:**	Peter Squire
Claims searched:	1 & 2	**Date of search:**	14 March 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): F2Y YPA YPC YPD YST YSX YTB

Int Cl (Ed.7): G05G 11/00 13/00 B66F 9/20, 22, 24

Other: Online:WPI,EPODOC,JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	JP4365798 A (Toyota) see abstract	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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